CLAIMS

1. A method of measuring conveyor belt elongation, wherein when the elongation of a running conveyor belt is measured, a magnetic field from a plurality of rubber magnets embedded in the conveyor belt is detected by a magnetism sensor provided so that the displacement in the conveyor belt length direction is restrained, and the elongation of conveyor belt is determined from temporal variations in the detected magnetic field.

2. The method of measuring conveyor belt elongation according to claim 1, wherein the elongation ε of conveyor belt is determined from Equation (1) of

$$\varepsilon = ((v \cdot ta - d)/d) \times 100(\%) \qquad (1)$$

where, ta is a time interval between two peaks appearing in the temporal variations in magnetic field detected by the magnetism sensor, v is a surface speed of conveyor belt, which is measured by a separate means, and d is a separation distance between the two peaks measured by relatively displacing the magnetism sensor in the conveyor belt length direction in a state in which the conveyor belt elongation is zero.

3. An apparatus for measuring conveyor belt elongation, which is used in the method of measuring conveyor belt elongation described in claim 1 or 2, wherein the apparatus comprises a plurality of rubber magnets embedded so as to be arranged in the conveyor belt length direction; a magnetism sensor, which is provided so that the displacement in the conveyor belt length direction is restrained, for detecting a magnetic field from the rubber magnet; and a belt speed measuring means for measuring the surface speed of a conveyor belt, and

the plurality of rubber magnets are arranged so that the direction of magnetic poles intersects at right angles to the surface of conveyor belt, and is opposite between the adjacent rubber magnets.

4. The apparatus for measuring conveyor belt elongation according to claim 3, wherein a width direction guide for regulating the position of conveyor belt in the widthwise direction is provided on both sides in the belt width direction of the magnetism sensor.

5. The apparatus for measuring conveyor belt elongation according to claim 3 or 4, wherein the plurality of rubber magnets are provided in the vicinity of a joint portion extending in the widthwise direction of a reinforcing material constituting the conveyor belt.

6. The apparatus for measuring conveyor belt elongation according to any one of claims 3 to 5, wherein the belt speed measuring means is formed by a means for measuring the rotational speed of a pulley around which the conveyor belt is set.

7. A method of measuring conveyor belt wear extent, wherein when the wear extent of the surface of a running conveyor belt is measured, a magnetic field from a rubber magnet which is provided in a desired portion of conveyor belt and a part of which is exposed on the conveyor belt surface is detected by a magnetism sensor fixed to the earth, and the wear extent of conveyor belt is determined from the magnitude of the detected magnetic field by utilizing a phenomenon that the magnetic field is varied by a decrease in volume of rubber magnet caused by the progress of wear of the desired portion of conveyor belt.

8. An apparatus for measuring conveyor belt wear extent, which is used in the method of measuring conveyor belt wear extent described in claim 7, wherein the apparatus comprises a rubber magnet provided in a desired portion of a conveyor belt and a magnetism sensor for detecting a magnetic field from the rubber magnet, the rubber magnet is arranged so that the magnetic poles are directed in the belt thickness

direction, and one magnetic pole is exposed on the conveyor belt surface.

9. The apparatus for measuring conveyor belt wear extent according to claim 8, wherein a width direction guide for regulating the position in the widthwise direction of a conveyor belt portion passing through a position close to the magnetism sensor is provided.

10. A method of measuring conveyor belt temperature, wherein when the temperature of a running conveyor belt is measured, a magnetic field from a temperature-sensitive rubber compound magnet embedded in a desired portion of conveyor belt is detected by a magnetism sensor fixed to the earth, and the temperature of conveyor belt is determined from the magnitude of the detected magnetic field by utilizing the phenomenon that the magnetic field varies depending on the temperature of the desired portion.

11. An apparatus for measuring conveyor belt temperature, which is used in the method of measuring conveyor belt temperature according to claim 10, wherein the apparatus comprises a temperature-sensitive rubber compound magnet which is embedded in a desired portion of conveyor belt and has magnetic poles of reverse polarity at both ends and a magnetism sensor for detecting a magnetic field from the temperature-sensitive rubber compound magnet, and

the temperature-sensitive rubber compound magnet has a property that a magnetic force varies in accordance with temperature variations in the predetermined temperature range.

12. The apparatus for measuring conveyor belt temperature according to claim 11, wherein the temperature-sensitive rubber compound magnet consists of a permanent magnet and a temperature-sensitive magnetic body connected to one magnetic pole of the permanent magnet so as to extend the permanent magnet, the

temperature-sensitive magnetic body having a property that the permeability decreases as the temperature rises in the temperature range, and

the permanent magnet and the temperature-sensitive magnetic body are formed by a bond magnetic body formed by mixedly dispersing magnetic particles into a rubber.

13. The apparatus for measuring conveyor belt temperature according to claim 11, wherein the temperature-sensitive rubber compound magnet consists of a permanent magnet and a temperature-sensitive magnetic body arranged around the permanent magnet, the temperature-sensitive magnetic body having a property that the permeability decreases as the temperature rises in the temperature range, and

the permanent magnet and the temperature-sensitive magnetic body are formed by a bond magnetic body formed by mixedly dispersing magnetic particles into a rubber.

14. The apparatus for measuring conveyor belt temperature according to any one of claims 11 to 14, wherein a width direction guide for regulating the position in the widthwise direction of a conveyor belt portion passing through a position closest to the magnetism sensor is provided.

15. The apparatus for measuring conveyor belt temperature according to any one of claims 11 to 15, wherein the magnetism sensor is provided in the vicinity of the downstream side in the conveyor belt running direction of a charging portion in which objects to be conveyed are charged.

16. A rubber magnet sheet comprising a matrix consisting of at least one kind of rubber component selected from a group consisting of butyl rubber and silicone rubber, and magnetically anisotropic magnetic

particles dispersed into the matrix, wherein

magnetic poles having a different polarity on the top and back surfaces are provided;

in a tensile test in conformance to DIN 3 standard, the breaking elongation at a rate of pulling of 100 mm/min is 10% or higher;

in the case where a cylindrical sample with a thickness of 0.5 mm, a width of 2 mm, and an inside diameter of 20 mm, is radially crushed under a radial crushing condition that the cylindrical sample is radially crushed at a stroke of 10 mm in the radial direction of the sample at a frequency of 2 times per second, the number of radial crushing cycles until the cylindrical sample is fractured is 10,000 or larger; and

in a flat sample sheet having top and back surfaces measuring 17 mm long by 17 mm wide by 1.3 mm thick, the magnetic flux density in the direction perpendicular to the top or back surface at a position 20 mm distant from the center of either of the top and back surfaces is 2 mT or higher.

17. The rubber magnet sheet according to claim 16, wherein the decrease in magnetic flux density after the flat sample sheet has been allowed to stand at ordinary temperature for 24 hours in an environment in which magnetism of a magnitude greater than the geomagnetism does not exist in the surroundings is 0.1% or less as compared with the case before the flat sample sheet is allowed to stand.

18. The rubber magnet sheet according to claim 16 or 17, wherein the decrease in magnetic flux density after 10,000 cycles of radial crushing under the above-described radial crushing condition is 0.1% or less as compared with the case before the radial crushing.

19. The rubber magnet sheet according to any one of claims 16 to 18, wherein the surface hardness specified in JIS S6050 is 50 to 90 degrees.

20. The rubber magnet sheet according to any one of claims 16 to 19, wherein the content of the magnetic particles is 50 to 75 percent by volume.

21. The rubber magnet sheet according to any one of claims 16 to 20, wherein the rubber component is butyl rubber, the degree of unsaturation is 0.3% or higher, and the Mooney viscosity $ML_{1+4}(100°C)$ is 60 or lower.

22. The rubber magnet sheet according to any one of claims 16 to 21, wherein the butyl rubber contains halogenated butyl rubber.

23. The rubber magnet sheet according to any one of claims 16 to 20, wherein the rubber component is silicone rubber, and the silicone rubber is heat curing silicone rubber or cold-setting RTV.

24. The rubber magnet sheet according to any one of claims 16 to 23, wherein the 50% diameters of the magnetic particles measured with a laser diffraction particle size distribution meter are 75 μm or smaller.

25. The rubber magnet sheet according to any one of claims 16 to 24, wherein the magnetic particles are subjected to surface treatment with a silane coupling agent.

26. The rubber magnet sheet according to any one of claims 16 to 25, wherein the magnetic particles are subjected to surface treatment with a surface oxidation inhibitor.

27. A method of producing the rubber magnet sheet according to any one of aspects claims 16 to 26, wherein the rubber magnet sheet is formed by accomplishing, in the named order, an unvulcanized sheet forming step in which a compound in which the magnetic particles are dispersed into the matrix is formed into a sheet shape; a temperature

raising step in which the unvulcanized sheet is heated to a temperature at which the compound softens; a magnetic field applying step in which a magnetic field is applied to the unvulcanized sheet in the thickness direction; a compressing step in which a compressive force is applied in at least one direction intersecting at right angles to the thickness direction while the unvulcanized sheet is kept at a high temperature and the magnetic field is still applied; a cooling step in which the unvulcanized sheet is cooled while the compressive force is still applied; a pressure relieving step in which the compressive force applied to the cooled unvulcanized sheet is relieved; a demagnetizing step in which the unvulcanized sheet is demagnetized; a vulcanizing step in which the unvulcanized sheet is vulcanized; and a magnetizing step in which the vulcanized sheet is magnetized.

28. The method of producing the rubber magnet sheet according to claim 27, wherein the steps from the temperature raising step to the pressure relieving step are performed by arranging the unvulcanized sheet in a die, and when the compressing step is performed, the unvulcanized sheet is compressed by a die movable portion provided so as to be displaceable in the compression direction.

29 The method of producing the rubber magnet sheet according to claim 27 or 28, wherein the magnetic field applied in the thickness direction of the unvulcanized sheet is removed in the cooling step or the pressure relieving step.